# Site Need Statement

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| **General Reference Information** | |
| 1 * | ***Need Title*:** Chemical Dissolution of Water Insoluble Wastes from Single Shell Tanks (SSTs) |
| 2 * | ***Need Code:*** RL-WT112 |
| 3 * | ***Need Summary*:** The low volume density gradient method of retrieval from the SSTs is currently only applicable to the soluble salts in the tanks. Essentially all tanks contain some insoluble material. Chemical methods are needed to dissolve and retrieve the insoluble material that will remain after the soluble salts are recovered. The methods must be compatible with carbon steel tanks. |
| 4 * | ***Origination Date*:** November 2001 |
| 5 * | ***Need Type*:** Technology Need |
| 6 | ***Operation Office*:** Office of River Protection (ORP) |
| 7 | ***Geographic Site Name*:** Hanford Site |
| 8 * | ***Project*:** Retrieval ***PBS No:*** RL-TW04 |
| 9 * | ***National Priority:***<br>____1. High - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule.<br>_X_2. Medium - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays).<br>____3. Low - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success. |
| 10 | ***Operations Office Priority*:** |
| **Problem Description Information** | |
| 11 | ***Operations Office Program Description*:**<br>The overall purpose of the Retrieve and Transfer SST Waste function is to move the waste from the SSTs into preferred storage in the DST system. A primary objective of this function is to develop and test alternative and improved retrieval technologies to past-practice sluicing. As part of this effort Leak Detection Monitoring and Mitigation (LDMM) approaches are being developed for concurrent deployment. To support this effort Cold Test Training & Mock-up Facilities are being established. The baseline end state of the Retrieve and Transfer SST Waste function is:<br>• Retrieval of all wastes from the SSTs<br>• The safe, environmentally compliant transfer of this waste to the SSTs<br>SSTs in a ready state for implementing closure and final disposal of the SST farms. |
| 12 | ***Need/Problem Description*:** The tank wastes have a varied chemistry. The majority of the waste is various salts of sodium and potassium stored on a wet, high caustic environment. However, much of the waste is in the form of sodium aluminum silicates and metal hydroxides, predominantly iron. These materials are stored in carbon steel tanks. The current plan envisions dissolving the soluble salts in water and pumping them from the tanks. This will leave behind the aluminum silicates and metal hydroxides. A chemical cocktail(s) is desired that will dissolve the remaining materials in the tank without significantly attacking the tank walls. It is desired that the dissolution can take place under conditions of short contact time, i.e., hours rather than weeks, and low mechanical agitation. The resulting stream must be compatible with pumped transfer and extended storage in carbon steel tanks. The chemical cocktail should be able to be destroyed with little residue in downstream processes. If released to the environment, the chemicals should breakdown so as not to present a long-term radionuclide mobility challenge in the Hanford soils. Because the receiving tank space is limited, it is desired that the chemical cocktail be able to retrieve the waste at concentrations of waste greater than 0.5 molar. Lower concentrations will be evaluated on an economic feasibility basis.<br><br>It is envisioned that organic complexants will be used to dissolve the water insoluble waste discussed |

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| | above. The complexants would exceed the Waste Treatment Plant feed specification for total organic carbon. It will be necessary to destroy these complexants before the wastes are sent to the Waste Treatment Plant. This task would identify a recommended technology to be used to destroy the organics. In addition it will perform any necessary development to allow DOE to procure the process for deployment in the tank farms. EM-50 did some development work on a broad selection of organic destruction technologies in the early 1990s. This could be a good starting point to select a preferred technology. The tank farm contractor will provide the detailed listing of requirements of the system.<br><br>Nuclear criticality safety currently requires that the solids particle size in waste disposed to RPP be demonstrably less than 10 ☒m. The requirement is based solely on hydrodynamics and was instituted because insufficient data exist on the actual distribution of plutonium to sludge-forming elements (e.g., iron, chromium, aluminum, and manganese) in actual HLW. Conversely, plutonium potentially can segregate from neutronic poisons present in current HLW by chemical mechanisms through HLW blending or retrieval operations, and thus constrain present or planned process operations. Information should be developed to insure that deployment of the above processes would not result in segregation of plutonium.<br><br>***Consequence of Not Filling Need:*** In the event that no satisfactory cocktail can be found the insoluble wastes will be retrieved by slurry or mechanical techniques at a significant cost penalty to the project. These methods are cost prohibitive for small volumes of waste residue remaining after saltcake dissolution.<br><br>** **Program Baseline Summary (PBS) No.:** TW04<br>** **Work Breakdown Structure (WBS) No.:** 5.02.01.01.01.01<br>** **TIP No.:** |
| 13 | ***Functional Performance Requirements*:** |
| ** | ***Schedule Requirements:*** |
| 14 | ***Definition of Solution*:** |
| 15 * | ***Targeted Focus Area*:** Tanks Focus Area (TFA) |
| 16 | ***Potential Benefits*:** |
| 17 * | ***Potential Cost Savings*:** $5-40 million per tank |
| 18 * | ***Potential Cost Savings Narrative*:** Current planning shows a cost of ~$30 million to retrieve saltcake tank, $40 million for tanks with mixed saltcake and sludge, and $77 million to retrieve sludge tanks. The use of a solution mining technique allows for a simplified mechanical system which could significantly reduce the cost of any of these waste retrieval activities. It is expected that a single organic destruction system would be required which when pro rated across the tanks would still result in significant savings to the baseline. |
| ** | ***Technical Basis:*** |
| 19 | ***Cultural/Stakeholder Basis*:** |
| 20 | ***Environment, Safety, and Health Basis*:** |
| 21 | ***Regulatory Drivers*:** |
| 22 * | ***Milestones*:** This technology would be deployed in SST retrieval as soon as it become available. The next opportunity occurs in 2002 with additional tanks being retrieved for more then 20 years thereafter. |
| 23 * | ***Material Streams*:** Sludge, salt, liquid (RL-HLW-20) |
| 24 | ***TSD System*:** Single Shell Tank systems |
| 25 | ***Major Contaminants*:** Pu-238, -239,-240, -241; Am-241; U-238; C-14; Ni-59/63;Nb-94; Tc-99; I-129; Cm-242; Cs-137, Sr-90, , Sn-126; Se-79; chromium; nitrate; nitrite; complexants (EDTA/HEDTA). |
| 26 | ***Contaminated Media*:** Tank waste consisting of supernate (liquid), salt cake, and sludge. For details, see, e.g., B. M Hanlon, "Waste Tank Summary Report for Month Ending June 30, 2001," HNF-EP-0182, Rev. 159, (CH2M HILL Hanford Group, Inc., Richland, WA, July 2001). |

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| 27 | ***Volume/Size of Contaminated Media*:** The single shell tanks are generally 75 ft. in diameter, and up to 40 feet deep with their tops buried about 10 feet below the ground surface. |
| 28 * | ***Earliest Date Required*:** October 2002 |
| 29 * | ***Latest Date Required*:** ~FY 2020 |
| **Baseline Technology Information** | |
| 30 | ***Baseline Technology(ies)/Process*:**<br><br>**Technology Insertion Point(s):** |
| 31 | ***Life-Cycle Cost Using Baseline*:** |
| 32 | ***Uncertainty on Baseline Life-Cycle Cost*:** |
| 33 | ***Completion Date Using Baseline:*** |
| **Points of Contact (POC)** | |
| 34 | ***Contractor End User POCs*:**<br>W. B. (Blaine) Barton, CHG, 509-376-5118, F/509-373-4641, W_B_Blaine_Barton@rl.gov |
| 35 | ***DOE End User POCs*:**<br>E. J. (Joe) Cruz, DOE-ORP, 509-372-2606; F/509-373-1313; E_J_Cruz@rl.gov |
| 36** | ***Other Contacts:***<br>A. F. (Anne-Marie) Choho, 509-372-8280, F/509-373-6382, Anne-Marie_F_Choho@rl.gov<br>K.A. (Ken) Gasper, CHG, 509-373-1948, F/509-376-1788, Kenneth_A_Ken_Gasper@rl.gov |

*Element of a Site Need Statement appearing in IPABS-IS
**Element of a Site Need Statement required by CHG